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Micronutrient Contents of Under-Utilized Spices Common in Nigeria

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Abstract - Vitamin and Mineral contents of five indigenous spices common in Nigeria were investigated. The spices include: 'bailo' (Uapaca guineense); 'atarko' (Zanthoxyllus zanthoxyloides); 'amilo' (Parinari excelsa); 'uburo' (Afromomum danelli) and 'clove' (Syzygium aromaticum). These samples are processed into fine flour, ashed at 5500c and later subjected to wet digestion using nitric sulphuric and perchloric acid. The mineral contents in mg/1 for iron, ranged from 0.99 (S.aromaticum) to 4.42 (U.guineense); zinc 1.24 (P.excelsa) to 3.81 (Uguineense); calcium 12.45 (Z.Zanthoxyloides) to 20.60 (A.danelli); magnesium 16.91 (P.excelsa) to 44.78 (A.danelli); potassium 48.97 (P.excelsa) to 153.66 (A.danelli); Sodium 64.77 (Z.Zanthoxyloides) to 155.70 (P.excelsa). The phosphorus contents for all the samples studied was insignificant. The data obtained for vitamin A showed that Z.Zanthoxyloides had the highest value (3.84 IU) and S.aromaticum the least (0.26 IU); while no value was detected for U.guineense and P.excelsa. Vitamin C contents also was highest for S.aromaticum (31.73/100g) and least for A.danelli (5.55mg/100g). These spices however can serve as mineral and vitamin supplements. The samples studied had good storage properties since they exhibited moisture content below 20%.

Keywords : *Indigenous spices, Vitamin, Mineral, Dry matter.*

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I. Introduction

Spices are condiments of plant origin consisting of parts of trees, seeds shrubs and grass which abound in the tropical rainforest and savannah grass land zones (Pearson, 1976). They are often referred to as food accessories or adjuncts because of their ability to stimulate appetite and increase the flow of gastric juice (Diezak, 1989). Some common examples are garlic, ginger, piper nigrum etc. They are used principally to spice foods, drinks and as medication for various ailments (Achinewhu, 1996; Nwiruka et al 2005).

Indigenous spices and herbs in Nigeria are mostly obtained from the wild (Abib 1994) and little attempt has been made to domesticate and cultivate them despite the fact that they constitute a large proportion of the daily diets of rural dwellers (Achinewhu, 1996). Although, they are used nutritionally in insignificant quantities, some researchers have argued that they can also contribute to the nutrient content of the food (Ranjith and Rosabalch, 1995).

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Studies have been carried out on spices mostly on their flavours and aroma (Agooha, 1981., Iwu, 1989), medicinal values (Gammaniel and Akalu, 1986); antinutrients (Nwinuka et al 2005., Nwachukwu and Ukoha, 2006, Ogunka-Nnoka and Mepba, 2008); as well as in drinks and beverages and in the production of perfumes (Aldelany and Bavrakat, 1970., Purseglove, 1991).

Spices cannot be recognized as major sources of macronutrients, but they can be potential sources of some micronutrients (Ranjith and Rosabalch, 1995; Achinewhu, 1996). Some under-utilized spices in Nigeria namely 'bafilo' (Uapaca guineense); 'atako' (Zanthoxyllus zanthoxyloides); 'amilo' (Parinari excelsia); 'uburo' (Afromonum danielli) and 'clove' (syzygium aromaticum) have been studied for their proximate and antinutritional factors and were found to contain antinutrients in low toxicity levels (Ogunka-Nnoka and Mepba, 2008). It will be necessary to expand the nutritional contribution towards knowing the amount of mineral and vitamin contents present visa vis their importance to health.

II. Materials and Methods

a) Sample source

Samples of 'Vapaca guineense, zanthoxyllus zanthoxyloides, Parinari excelsa, Afromum danelli and syzygium aromaticum were purchased from local farmers from Ughelli at the fruit garden market in Port Harcourt, Rivers State Nigeria.

b) Sample preparation

Samples (300g each) were sorted and cleaned to remove rotten seeds and debris. The seeds were dehulled and oven dried at 600c for 12 hours. Dried samples were separately ground in a kenwood food processor, Model 967 England, then sieved to 300 min mesh. The processed spices were packaged in sealed low density polythene bags and stored in a desiccators for subsequent analysis.

III. Chemical Analysis

a) Mineral analysis

Metals such as sodium (Na) potassium (k) calcium (Ca), Magnessium (mg), 'iron (fe) and zinc (zn) were of analysed from the indigenous spices. Samples were digested following the procedure described by Salami and Non, (2002). Briefly, samples (1.0g each of

oven dried flour were digested with 5ml concentrated nitric acid ($HN0_3$) and 1ml each of concentrated sulphuric acid ($H2SO_4$) and 60-62% *perchloric* acid ($HCLO_4$) and heated until white fumes of perchloric acid formed. The volume of the digest was reduced by heating but not to dryness. The flask was set aside to cool, after which the content was diluted with distilled deionized water and then filtered into a 50ml volumetric flask. The content was made up to mark with deionized water and stored until analyzed for mineral contents using Atomic Absorption spectrophotometer (AAS), phosphorous content of the digest was determined spectrophoto metrically according to method described by Nahapetain and Bassiri (1975).

b) Vitamin A and C analysis

Vitamin A content was determined using antimony trichloride as described by Kefford et al, 1974, while vitamin C content was determined using the EDTA/TCA extraction method as described by Baraket et al, 1973.

IV. Dry Matter Content

Dry matter content of the sample were determined by the AOAC, 1995 method.

a) Statistical analysis

The data obtained were subjected to analysis of variance (ANOVA) to determine any significant difference at 5% level using steel and Tornic (1980) method. Means were separated by Duncan's New multiple range test to establish if there were significant differences between the samples (Wahua, 1999).

V. Results and Discussion

Table 1 shows the moisture contents of the spices studied. The moisture contents obtained were 13.56, 12.16, 12.01, 11.83 and 10.67% for S.aromaticum, A.danielli U.guineese, P.excelsia and Z.zanthoxylloides, while the corresponding values of dry matter are 86.44, 87.84, 87.99, 88.17 and 89.33% respectively. The values shows that almost 90% of the spices consist of dry matter content although S.aromaticum had a significant moisture compared to the other samples.

The moisture obtained in this result slightly varied from the previous reports (Ogunka-Nnoka and Mepba, 2008). This may be attributed to seasonal variation or processing methods. The result generally corroborates the reports of Nwachukwu and Ukoha, 2006 for other indigenous spices.

Table 1 : Moisture and dry matter contents of the spices.

Sample	Moisture contest(%)	Dry matter contents
U.guineense	12.01^{b}	87.99^{ab}
Z. zanthoxylloides	10.67^{c}	89.33^{a}
P.excelsia	11.83^{b}	88.17^{a}
A.danelli	12.11^{b}	87.84^{ab}
S. aromaticum	13.56^{a}	86.44^{c}

Values are means of triplicate determination. Means in the column not followed by the same superscripts differ significantly.

The results of mineral contents of the spices are shown in table 2. the Fe (4.42mg/1), and Zn (3.81mg/l) levels were significantly ($p \leq 0.05$) high in U.guineese while S.aromaticum and P.excelsia were relatively low in Fe (0.99mg/l) and Zn (1.24mg/l) contents respectively. Ca (20.60mg/l) and Mg (44.78mg/l) were significantly ($P \leq 0.05$) high in Adanielli; while Na (155.70mg/l) and K (153.66mg/l) were significantly high in P.excelsia and A.danielli respectively. Relatively low values of Ca (12.45mg/l) and Na (64.77mg/l) were obtained for Z.zanthoxylloides. P.excelsia had low values of Mg (16.91mg/l) and K (48.97mg/l). Phosphorus level was insignificant in all samples studied.

Potassium plays a large role in supporting the nervous system and natural heart rhythm. It stabilizes blood pressure and help in electrochemical transmission and has been shown to prevent strokes. It also works with sodium to maintain a proper water balance in the body (Jennifer, 2009). These spices, especially *P.excelsia* and *A.danielli* being highly rich in Na and K respectively may be used therapeutically in the area of medicine and to meet the RDA in infants and adults (Bamishaiye et al., 2011). However the high levels of Na in these samples will not favour their incorporation in the diet of obese and hypertensive patients; based on the fact that the effect of high sodium intake on cardiac failure is well known (Sofola, 1981; Olowoyeye, 1981). The moderate level of iron and the relatively low Zn contents could still serve for medicinal purpose. Since iron is vital for the production of haemoglobin, formation of red blood cells and the oxygenation of red blood cells. Iron also improves circulation, digestion, elimination and respiration Zinc promotes a healthy immune system, taste, smell, joint, and connective tissue, cell division, repair and growth and helps in the proper functioning of insulin (Jennifer,

2009). The recommended daily intake is between 8-15 mg/ and dose larger than 25mg may cause anaemia and copper deficiency (Lenntech water treatment and B.V. purification, Holdings, 2005). The level of Zn in these samples meets the recommended dietary requirements and agrees with the result obtained by Bamishaiye et al., 2011 for Zobo drink. The concentration of Ca and Mg in these samples are moderate. Calcium is quantitatively most abundant mineral in the body and in ionic form it regulates transport across the cell wall. Also, the cells need calcium such that 99% of calcium in the body is used for healthy teeth, bones and muscles growth, while magnesium has a vital role in a varying range of biochemical and physiological process including binding to ATP to form active ATP, contributing to DNA and RNA synthesis, nerve and heart function as it brings about decrease in blood pressure. It has been reported that mg and Ca serve as cofactors in a number of enzyme systems and are involved in neurochemical transmission and muscular excitability. Severe deficiency of Mg causes, tetany just like when calcium level falls (Ukoha, 2006). Consuming these species will definitely contribute to the required daily allowance (RDA) of infants and adults. The amount of mineral content reported in this study may vary based on factors like the time of harvest, method of processing and the type of planting soil. It is also possible that most of the moisture lost during processing may contain some mineral. These spices contain low toxic levels of antinutrients making it possible for the minerals to be easily absorped without any interference.

Table 2 : Mineral contents of the spices.

Minerals (mg/l)	SAMPLES				
	U.guineense	Z. zanthoxylloides	P. excelsia	A. danielli	S. aromaticum
Fe	4.42^{a}	2.22^{b}	1.14^{b}	3.92^{a}	0.99^{bc}
Zn	3.81^{a}	1.61^{b}	1.24^{b}	1.84^{b}	1.62^{b}
Ca	17.43^{b}	12.45^{c}	13.47^{c}	20.60^{a}	13.98^{c}
Mg	29.24^{b}	21.59^{c}	16.91^{c}	44.78^{a}	17.55^{d}
Na	121.60^{b}	64.77^{e}	155.70^{a}	110.22^{c}	76.36^{d}
K	53.14^{c}	60.46^{b}	48.97^{d}	153.66^{a}	60.38^{b}
P	<0.01>	<0.01>	<0.01>	<0.01>	<0.01>

Values are means of triplicate determinations. Means in the same column not followed by the same superscripts differ significantly (P. ≤0.05).

The vitamin A and C contents are shown in Table 3 below. The vitamin A content was significantly (P. ≤0.05) high in Z.zanthoxylloides (3.84IU) and was not detected in U.guineense and P.excelsia. All samples with the exception of A.danielli had appreciable yield of vitamin C. Absence of vitamin A in some spices may not be clearly explained; however, one could suggest that the intrinsic lipid properties that identifies vitamin A as fat soluble vitamin may be lacking in these samples. The high vitamin C concentration is an added advantage in prophylactic control of malignant growths like cancer and the effects of free redical damage which leads to aging (Nwaoguikpe, 2009). As an antioxidant, it also help in the production and maintenance of collagen (Matters and Wildowson, 1992).

These results can be compared with the report by Okwu and Josiah, (2006) for A.Africana and B. Pinnatum. However, vitamin C content of these spices results are lower than what Nwachukwu and Ukoha, 2006 reported Zylopia aethiopica (89.76 mg/100g), and piper guineense (117.68mg/100g) The appreciable mineral and vitamin C contents of these spices and also the significant yield of vitamin A in Z.zanthoxylloides reveals the nutritional importance of these spices.

Table 3 : Vitamin contents of the spices.

Sample	Spices Vitamin A	Vitamin C
U.guineense	ND	17.72^{c}
Z. zanthoxylloides	3.84^{a}	16.54^{c}
P.excelsia	ND	21.85^{b}
A.danelli	0.38^{b}	5.55^{d}
S. aromaticum	0.26^{b}	31.73^{a}

Values are means of triplicate determinations. Means in the same column not followed by the same superscripts differ significantly (P. ≤0.05).

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